The Sustainium Effect and Step-up Penalties of Sustainability-Linked Bonds

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Abstract

Given the pressing need for sustainable economic transformation and the existing funding gap for global sustainability goals, our study investigates the financing benefits of sustainability-linked bonds (SLBs) for issuers pursuing sustainable corporate transformation. As a novel innovation in the bond market, SLBs incentivize sustainability by linking financial rewards or penalties to the achievement of sustainability performance targets (SPTs). We evaluate primary market yield differentials by comparing 90 corporate SLBs issued between 2021 and 2023 with conventional bonds (CBs) from the same issuers and with similar characteristics.

Our findings reveal that SLBs have lower initial yields compared to CBs, with an average difference of -13.31 to -30.21 basis points (bp). This yield advantage, referred to as "sustainium", reflects the growing investor preference for ESG-focused investments. Our analysis indicates that the sustainium is smaller for EUR-SLBs and larger for callable bonds. We find no significant impact of coupon step-up penalties and target maturities on the yield differential. These findings raise concerns about ESG washing, emphasizing the importance of stricter regulation and diligent investor scrutiny.

Keywords: Sustainability-linked bonds, Sustainium, ESG, ESG washing

JEL classification: G23, Q56, G32, M14

1 Introduction

In October 2023, bond market experts started to express concern that the Italian energy company Enel, the world's largest issuer of sustainability-linked bonds (SLBs) with more than 30 SLBs outstanding, would receive the market's largest ever step-up payment due to Enel's failure to meet its emissions targets. In May 2024, it was officially confirmed that the coupon on ten Enel SLBs would increase by 25 basis points, increasing the issuer's interest burden by EUR 83 million. This event highlights the relevance of step-up penalties in the composition of bond characteristics and its consequences for the initial yield of SLBs.

The International Energy Agency (IEA) estimates that investments of $100 to $150 trillion will be required between 2020 and 2050 to achieve the United Nations Sustainable Development Goals (SDGs) (Maino, 2022). The vast financing needs for a sustainable transition highlight the inadequacy of relying solely on public funding, particularly in light of the SDG funding gap exacerbated by the pandemic (OECD, 2022). Therefore, the role of the private sector and financial institutions in the efficient mobilization and allocation of capital is crucial (Maltais & Nykvist, 2020; Berrada et al., 2022). In response to these financial demands, debt instruments tailored to sustainability objectives have emerged in the financial market, starting with green bonds and followed by social and sustainable bonds (Berrada et al., 2022; Torricelli & Pellati, 2023). These instruments, known as use-of-proceeds bonds (UoPBs), ensure that the proceeds are used exclusively to finance or refinance projects with environmental or social benefits (Vulturius et al., 2022; ICMA, 2021). Dahlem et al. (2024) provide evidence from simulation studies that the inclusion of additional incentives to reduce carbon emissions would make UoPBs such as green bonds more effective.

This incentive setting is a basic idea of SLBs. Unlike traditional bonds or UoPBs, SLBs link financial conditions to the achievement of pre-defined sustainability performance targets (SPTs) within a specified timeframe (CBI, 2022; Antilici et al., 2022). These targets are tied to measurable key performance indicators (KPIs) related to environmental, social and governance (ESG) factors, such as greenhouse gas (GHG) emissions reductions relative to an established baseline or workforce diversity metrics (Koelbel & Lambillon, 2022; Berrada et al., 2022). Crucially, these targets must be both material and ambitious enough to demonstrate a genuine commitment to sustainability. This strategy serves to address concerns about superficial sustainability claims, often labeled as "ESG washing" (Uzsoki & Rahim, 2021). SLBs allow issuers to use the proceeds at their discretion, facilitating broader engagement in sustainability improvements for firms that may not have specific projects to finance. Consequently, they encourage companies to pursue holistic sustainability goals and promote comprehensive sustainability practices at all organizational levels (Liberadzki et al., 2021; Berrada et al., 2022).

Within the structure of SLBs, issuers are afforded flexibility in establishing rewards and penalties, most commonly through a "coupon step-up" mechanism that increases the coupon rate if the sustainability targets are not met within the specified time period (Chang, 2022; Ul Haq & Doumbia, 2022). Thus, failure to meet these targets has financial consequences for issuers and may also lead to reputational damage. In this way, SLBs incentivize issuers to enhance their ESG practices by integrating measurable and externally verifiable targets that signal a robust commitment to sustainability (Koelbel & Lambillon, 2022; Povilonis, 2022). Given the recent emergence of SLBs in the global debt market and the case of Enel, there is still only a limited understanding of the financial benefits for issuers and the level of initial yields for SLBs compared to their conventional counterparts (termed as "sustainium") and the penalty incentive on this sustainium. We address this research gap and evaluate the pricing of corporate SLBs in the primary market from 2021 to 2023 with respect to the impact of SLB features such as target maturities and penalty structures on their initial yields.

The paper is organized as follows. Section 2 presents a literature review, followed by an outline of our hypotheses. Section 3 details the methodology, data selection and matching procedure. Section 4 provides descriptive statistics for the collected SLB data and the matched sample. Section 5 presents the results of the empirical analysis with respect to our hypotheses. The empirical findings are discussed in section 6. Section 7 ends with a conclusion and an outlook.

2 Literature Review and Hypotheses Development

The greenium of green bonds is often interpreted as the result of increasing investor demand for ESG-focused assets based on heightened environmental consciousness, regulatory incentives for green investments, anticipated economic impacts of climate change, and the limited availability of such products (Agliardi & Agliardi, 2021; Zerbib, 2018; Liberadzki et al., 2021; Gianfrate & Peri, 2019). However, empirical studies provide conflicting evidence regarding the existence of a greenium over recent time spans. Early studies indicate that green bonds yield less than CBs, with results ranging from -2 bps to -20 bps, underscoring the potential financial benefits for green bond issuers (Loeffler et al., 2020; Gianfrate & Peri, 2019; Kapraun et al., 2021; Zerbib, 2018, Hachenberg & Schiereck, 2018). This yield advantage appears to be influenced by factors like the bond's credit rating, issuer type, and ESG rating. In particular, lower-rated investment-grade and public sector bonds exhibit a more pronounced greenium (Arat et al., 2023; Ehlers & Packer, 2017; Hachenberg & Schiereck, 2018; Kapraun et al., 2021). Furthermore, the impact of bond certification, issuer region, and primary sector on the greenium indicates the importance of credibility, genuine sustainability impact, and sector-specific considerations (Bour, 2019; Agliardi & Agliardi, 2021; Pietsch & Salakhova, 2022). In contrast, other studies consider the greenium to be negligible or even non-existent (Flammer, 2021; Tang & Zhang, 2020; Larcker & Watts, 2020; Lau et al., 2022).

Following the discussion on green bonds, our attention shifts to SLBs and the sustainium effect. Recent evidence suggests that SLBs have lower issuance yields compared to their conventional counterparts, indicating capital cost advantages for SLB issuers (Koelbel & Lambillon, 2022; Ramirez et al., 2022; Bonacina, 2022). Koelbel and Lambillon (2022) examine 102 SLBs in comparison with CBs by the same issuers and identify a notable sustainability premium, averaging -29.2 bps. However, they also show that only 65% of SLBs benefit from this premium, while the remainder either receive no premium or face higher costs. In addition, they observe no significant effect of ESG ratings on the sustainium. Nevertheless, they find that the yield benefit is more prominent for SLBs with higher coupon steps and those featuring call options. Conversely, Ramirez et al. (2022) note that the callability of SLBs, as well as differences in issue dates and maturities relative to conventional counterparts, do not significantly affect the sustainability premium. They identify country of incorporation, sector, and type of SPT as significant determinants of SLBs' performance. According to Bonacina (2022), SLBs typically offer yields that are 36 to 104 bps lower than their conventional counterparts. This reduced capital cost is identified as a key driver for SLB issuance. Bonancia note that factors such as the bond's tenor and issuance volume influence these yields. In contrast, Vejarano and Swinkels (2023) report a minimal yield differential, no more than 5 bps, between SLBs and CBs with similar risk profiles.

The findings of Koelbel and Lambillon (2022) further highlight the efficacy of a "free lunch" for SLB issuers, as evidenced by the discrepancy between the average sustainium of -29.2 bps and the mean coupon step-up penalty of 26.6 bps. This divergence suggests the potential for net savings, even in the absence of issuers meeting SPTs. In addition, Ramirez et al. (2022) support this finding, reporting that SLBs in the EU exhibit an average yield advantage of -53 bps and a coupon step-up penalty of 30.9 bps. Liberadzki et al. (2021) also confirm that the sustainium persists even with definitive coupon increases, indicating that a coupon step-up merely reduces the sustainability premium, but does not eradicate it. Ul Haq and Doumbia (2022) point out that SLB issuers employ strategies, such as incorporating call options and setting later SPT dates, with the objective of maximizing financial benefits and mitigating the impacts of unmet SPTs. However, failure to achieve SPTs may result in reputational damage, which could indirectly encourage issuers to adhere to their targets.

Despite the apparent financial advantages for issuers, the alignment of these financial instruments with genuine sustainability goals is open to debate. The consensus acknowledges both potential benefits and challenges of linking financial incentives to a real commitment to sustainability. Issuing SLBs may come at a higher cost, mainly due to the stringent reporting requirements and internal governance measures (Bonacina, 2022). Nevertheless, SLBs have a key advantage: they may facilitate access to capital at lower interest rates, thus reducing borrowing costs, while giving issuers some flexibility in the allocation of funds. Observations in the green bond market indicate that investors tend to tolerate lower returns when bonds meet their sustainability criteria (Maltais & Nykvist, 2020). Initial research suggests that SLBs may also have lower yields than CBs, indicating lower risk (Koelbel & Lambillon, 2022; Bonacina, 2022). Thus, despite potentially higher upfront costs, SLBs may represent a more

economical solution for companies seeking capital to transition to sustainability. Consequently, if sustainability factors affect returns, then the issuance yield to maturity (YTM) of sustainable bonds should be lower than that of non-sustainable bonds. This observation leads to our first hypothesis:

Hypothesis 1. The issuance yields of SLBs are lower than those of their conventional counterparts, resulting in a sustainium.

Research by Koelbel and Lambillon (2022) suggests a correlation between the level of coupon step-up penalties for non-compliance with sustainability targets and SLBs' yields. A higher penalty correlates with a larger negative yield spread relative to CBs. One possible explanation for this trend is that the market views more severe penalties as a credible deterrent against potential greenwashing. Such credibility not only increases the attractiveness of these bonds for socially and ecologically conscious investors, but it could also be viewed as a reward for issuers' genuine commitment to sustainability efforts. Consequently, it can be hypothesized that issuers of SLBs with higher step-up penalties will find more favorable yield conditions compared to CBs than SLBs with lower step-up penalties. This assertion gives rise to our second hypothesis:

Hypothesis 2. SLBs with higher (stricter) penalty basis points exhibit a larger sustainium.

Ul Haq and Doumbia (2022) point to a tendency for issuers to strategically set later dates for meeting sustainability targets, presumably to minimize potential penalties. These findings raise concerns that some issuers may exploit SLB features for financial gain, possibly at the expense of the fundamental sustainability intent of the instrument. However, the authors omit an examination of investor reactions to these potential penalty mitigation tactics by SLB issuers. Thus, our research objective is to determine whether investors incorporate this potential dilution of sustainable objectives into their valuations and subsequently demand higher yields on bonds that are perceived as green- or ESG washing. The focus of this analysis is on the target maturity ratio, a metric that measures the proportion of target duration within the bond's overall tenure. A higher ratio allows issuers more time to fulfill their targets. Longer target maturities reduce the likelihood of missing SPTs and the resulting reputational harm. Therefore, an extended timeline may be perceived as a dilution of the commitment to immediate sustainability efforts. Consequently, this strategy could be interpreted as ESG washing, which implies that issuers project a facade of sustainability commitment without substantive action. Thus, it can be hypothesized that SLBs with lower target maturity ratios might benefit from more favorable yield conditions relative to SLBs with higher target maturity ratios. Our third hypothesis is based on this premise:

Hypothesis 3. SLBs with lower target maturity ratios exhibit a larger sustainium.

3 Data, Methodology and Matching

The primary objective of this study is to explore the existence of a sustainability premium, or sustainium, defined as the yield advantage SLBs may hold over CBs. Additionally, this study examines the impact of coupon step-up penalty levels and the timeframe for meeting the SPT relative to the bond's maturity date and YTM spread at issuance. Adopting a bond-level matching strategy, similar to that proposed by Koelbel and Lambillon (2022), ensures a methodological comparison between SLBs and CBs. In this way, we focus on minimizing confounding variables to effectively isolate YTM differences attributable to sustainability considerations and investor preferences (Zerbib, 2018; Ramirez et al., 2022).

Our dataset includes SLBs issued from 2021 to 2023 and CBs from 2018 to 2023 (up to September 16th). This approach was taken to circumvent potential bond pricing anomalies in 2020 due to the impact of the COVID-19 pandemic and to account for the sparse issuance of SLBs in preceding years. Our research focuses on corporate bonds at the tranche level using Refinitiv's comprehensive fixed income database via the Eikon Data API. To ensure the reliability and consistency of our findings, we apply a series of rigorous inclusion criteria to create a homogeneous sample that excludes bonds with unique characteristics such as Islamic finance bonds, pandemic bonds, and those lacking specified issuance amounts. Furthermore, our dataset only encompasses bonds that are either non-callable or callable after a specified date.

Based on the specified inclusion criteria, we identify 381 SLBs and 141,227 CBs for our initial dataset. It is noteworthy that the CB category explicitly excludes bonds identified as green, social, sustainable, or blue, in order to clearly differentiate conventional from sustainability-oriented issuances. Our methodology incorporates risk-free yields, which are essential in bond pricing (Merton, 1974; Elton et al., 2001). These yields are obtained from the Refinitiv government bond benchmark index. We align the issue date of each bond with the corresponding risk-free rate to accurately mirror market conditions at the time of issuance. Following the methodology proposed by Koelbel and Lambillon (2022), bonds with a maturity exceeding 7.5 years adopt a 10-year risk-free yield, while the remainder utilize a 5-year rate. Next, we include the bond's creditworthiness, which indicates the issuer's capacity to fulfill its debt obligations and influences investors' risk assessments. To ensure analytical consistency, we harmonize the various credit ratings into a 23-level numerical scale, ranging from AAA (23), AA+ (22) to D (1).

To further refine our initial dataset for the matching process, we standardize it to preserve risk homogeneity and mitigate pricing discrepancies arising from unique bond features. In short, we pair senior, unsecured, non-perpetual, fixed coupon bonds with an issue size exceeding EUR 80 million. Each pair meets rigorous criteria to ensure comparability: matching in maturity type (at-maturity or callable),

rating classifications (investment grade or non-investment grade), currencies, issuers, and credit ratings (with pairs only being matched if the SLBs and CBs have coinciding credit ratings or lack ratings altogether). In addition, bonds with minimal differences in issue date, maturity and issue volume are matched using the Euclidean distance method to select the most compatible counterparts. Recognizing the impact of economic conditions on bond comparability (Koelbel & Lambillon, 2022), we limit issuance date differences to a maximum of 1460 days, or 4 years. Maturity gaps are also capped at three years, and issue size deviations are confined to 100%, corresponding to an SLB to CB ratio between 0.5 and 2. This rigorous selection process culminates in a final sample of 90 matched bonds.

For the empirical analysis, we use both univariate and multivariate methods to examine the differences between the issuance yields of SLBs and their conventional counterparts. The univariate analysis focuses on the risk-adjusted yield to maturity (RAYTM) differentials, employing paired two-sample t-tests and Wilcoxon signed-rank tests. We calculate RAYTM by offsetting the YTM against the predetermined risk-free benchmark rate. This procedure isolates the credit risk premium for both bond types while incorporating the term premiums (Huang et al., 2023).

We construct three regression models (OLS) for multivariate analysis, with issuance yield serving as the dependent variable. Our bond matching methodology posits that yield differentials are predominantly driven by the sustainability attributes of the bonds. To mitigate potential bias, both unmatched and matched control variables are introduced. Unmatched variables represent characteristics that could differ within bond pairs, such as bond tenor. Matched variables are attributes with identical values for SLBs and CBs. This approach allows us to control for potential confounding factors and ensure an unbiased estimate of the SLB effect.

To control for other factors that might affect yield differentials apart from the sustainability dimension, we introduce the "yield differential driver model", which identifies factors that influence the sustainability premium. In this model, bond pairs are merged into a single synthetic bond. This approach efficiently captures the unique characteristics of each bond and offers a streamlined metric for comparative analysis. Consequently, the regression employs the yield differential at issuance as the dependent variable, defined as the difference between the YTM of SLBs and CBs. A consolidated overview of the regression variables can be found in Table 1.

Variable	Description	Type	Unit
SLB	1 for sustainability-linked bonds; 0 for conventional bonds	Qualitative	Binary
Risk free yield	Risk-free yields are sourced from the Refinitiv benchmark government bond index at the bond's issue date: maturities exceeding 7.5 years use a 10-year yield, others a 5-year yield.	Quantitative	Percentage Points (0% – 100%)
Issue Volume	Proceeds from the bond issue	Quantitative	Log (EUR millions)
Maturity	Term of the bond at issuance in years.	Quantitative	Years
Currency	1 for EUR bonds; 0 for others	Qualitative	Binary

Investment Grade	1 for investment grade bonds; 0 for speculative bonds	Qualitative	Binary
Callable	1 for callable; 0 for at-maturity bonds	Qualitative	Binary
Total assets	Sourced from the issuer's annual balance sheet. If missing for the issuance year, the last available balance sheet or quarterly statement is used.	Quantitative	Log (EUR millions)
Total leverage	Equivalent to Total Assets.	Quantitative	Percentage Points (0% – 100%)
Sector	Binary variable for each Refinitiv TRBC Economic Sector; 1 for presence, 0 for absence, with Healthcare Sector as reference category.	Qualitative	Binary
Rating Grade	Continuous credit rating scale from 1 (D) to 23 (AAA), with values such as AA+ at 22 and CC at 3.	Quantitative	Numeric (1 – 23)
ESG-Score	ESG ratings by Refinitiv for the issuer	Quantitative	Percentage Points (0% – 100%)
Step-up	Coupon Step-up Penalty, when issuer fails to meet SPT until SPT Target Date.	Quantitative	Basis points
Target Maturity Ratio	$\frac{SPT\ Target\ Date\ in\ Years}{Maturity\ in\ Years} * 100$	Quantitative	Percentage Points (0% – 100%)
Risk-free Yield Difference	$RiskfreeYield_{SLB} - RiskFreeYield_{CB}$	Quantitative	Percentage Points (0% – 100%)
Issue Date Difference	$IssueDate_{CB} - IssueDate_{SLB}$	Quantitative	Years
Maturity Difference	$Maturity_{SLB} - Maturity_{CB}$	Quantitative	Years
Issue Volume Ratio	$\frac{IssueVolume_{SLB}}{IssueVolume_{CB}}$	Quantitative	Percentage Points (0% – 100%)
Total Assets Ratio	$\frac{TotalAssets_{SLB}}{TotalAssets_{CB}}$	Quantitative	Percentage Points (0% – 100%)
Total Leverage Difference	$TotalLeverage_{SLB} - TotalLeverage_{CB}$	Quantitative	Percentage Points (0% – 100%)

Table 1: Summary of the regression variables.

4 Descriptive Statistics

During the sample period, 244 firms issued 381 SLBs with a total volume of EUR 154.71 billion. Following an initial surge, the market seems to be contracting, as evidenced by consistently negative annual growth rates post-2021 in bond numbers, issuance volume, and issuer count (Table 2). This downturn may be attributed to the intensification of macroeconomic uncertainties and geopolitical tensions. As a result of increased inflation, central banks in advanced economies have raised interest rates since 2022 (CBI, 2022). This has had a significant impact on the broader bond market, reflected in historic sell-offs and a continued inversion of the risk-free yield curve. Furthermore, the SLB sector has also been affected.

	2021	YoY Growth	2022	YoY Growth	2023 (09/16/23)	Total
Amount Issued (EUR millions)	70938.01	- *28.49%*	50728.61	- *34.87%*	33039.31	154705.94
Bonds (Number)	167	- *26.35%*	123	- *26.02%*	91	381
Issuers (Number)	120	- *30.00%*	84	- *13.10%*	73	244
Issue Volume Mean (EUR millions)	424.78	- *2.91%*	412.43	- *11.97%*	363.07	406.05
Issue Volume Median (EUR millions)	409.55	- *15.13%*	347.60	- *20.89%*	274.98	349.14
YTM Mean (bps)	284.36	+ *21.38%*	345.17	+ *31.90%*	455.29	344.14
RAYTM Mean (bps)	240.28	- *15.33%*	203.44	+ *20.48%*	245.11	229.08

Table 2: SLBs over time.

Tables 3 and A.1 in the Appendix provide information on the currency and regional dynamics of SLB issuances. European corporates lead the SLB issuance with a 64.16% (EUR 99.26 billion) share of the total volume, accounting for 55.15% of the overall issuance amount.

Currency	2021	YoY Growth	2022	YoY Growth	2023 (09/16/23)	Total
EUR (EUR millions)	40464.81 (57.04%)	- *41.39%*	23716.44 (46.75%)	- *10.86%*	21139.79 (63.98%)	85321.04 (55.15%)
USD (EUR millions)	22444.77 (31.64%)	- *22.80%*	17328.26 (34.16%)	- *68.02%*	5542.10 (16.77%)	45315.14 (29.29%)
JPY (EUR millions)	930.59 (1.31%)	+ *174.25%*	2552.17 (5.03%)	+ *21.49%*	3100.54 (9.38%)	6583.31 (4.26%)
CNY (EUR millions)	820.64 (1.16%)	+ *157.97%*	2116.98 (4.17%)	- *82.20%*	376.88 (1.14%)	3314.51 (2.14%)
GBP (EUR millions)	904.16 (1.27%)	+ *77.18%*	1601.97 (3.16%)	- *78.29%*	347.85 (1.05%)	2853.98 (1.84%)
CAD (EUR millions)	1241.70 (1.75%)	- *88.75%*	139.69 (0.28%)	+ *337.45%*	611.07 (1.85%)	1992.47 (1.29%)
SEK (EUR millions)	949.61 (1.34%)	- *52.43%*	451.76 (0.89%)	- *19.48%*	363.77 (1.10%)	1765.14 (1.14%)
Other (EUR millions)	3181.73 (4.49%)	- *11.33%*	2821.34 (5.56%)	- *44.80%*	1557.29 (4.71%)	7560.36 (4.89%)
Total Issue Volume	**70938.01**	**- 28.49%**	**50728.61**	**- 34.87%**	**33039.31**	**154705.94**

The percentage indicates the share of the currency in the total issue volume of the respective column.

Table 3: SLBs by denominated currency and over time.

The SLB market is characterized by senior unsecured investment-grade bonds, with the utilities, industrial, financial, consumer non-cyclical, and basic materials sectors dominating issuance (Tables A.2, A.3 and A.4). This sectoral diversity underscores the SLB market's inclusiveness, in contrast to the

more homogeneous composition of the green bond market, which is mainly characterized by the government, financial and energy sectors (Schiereck & Pohl, 2023; Chang, 2022; Zerbib, 2018). The market's inclusiveness extends to firm size, with significant participation from mid- and small-cap firms in addition to large-cap entities. Furthermore, SLB issuers tend to possess higher ESG scores, reflecting the prevalence of sustainability-oriented firms in this market segment (Table 15 in the Appendix).

Callable bonds predominate (over 80% of the total issuance volume), indicating the issuers' preference for financial flexibility (Çelik et al. 2019; Koelbel & Lambillon, 2022). An analysis of SPTs reveals a priority on environmental objectives, especially GHG emissions reduction, with the "coupon step-up" mechanism as the most common penalty for failing to meet SPTs (Tables A.6, A.8 and A.9). The mean penalty rates for step-up bonds are 26.38 bps, which is consistent with Koelbel and Lambillon's (2022) observation of 26.6 bps. The mean target maturity ratio for all SPTs is 64.26%, with a median of 66.48% (Table 4).

Variable	#Targets	Min	1th Quartile	Mean	Median	3th Quartile	Max
Coupon Step-Up (bps)	290	2	12.50	26.38	25	25	150
Target Maturity Ratio Coupon Step-up (pp)	290	2.42	47.88	60.01	60.97	74.91	99.24
Target Maturity Ratio (pp)	443	2.42	51.29	64.26	66.48	81.71	99.24

Table 4: Descriptive statistics of penalty rates and target maturity ratios of SPTs.

Our matched sample of 90 bond pairs exhibits a high degree of similarity to the overall SLB dataset in terms of issue sizes, maturities, and various metrics, including ESG scores, bond credit ratings, coupon step-up penalty levels, and target maturity ratios (Tables 5 and A.10). The sample encompasses 23.62% of all SLB issues (90 out of 381), representing 25.44% of the total market volume (EUR 39.36 billion) and covering 27.87% of all issuers (68 out of 244). However, our matched sample tends to include larger firms, as indicated by the difference in issuers' average total assets compared to the overall market. The inclusion of diverse regions, particularly those in Asia, offers new insights into the global investor attitudes towards SLBs (Tables 5, A.11, A.12 and A.13).

A comparison of the matched pairs shows that they have similar issue sizes and the average maturity discrepancy tends towards zero. However, SLBs are issued on average 1.39 years after their conventional counterparts, which is within the bounds set by our matching criteria. Furthermore, a detailed examination of YTM and RAYTM reveals substantial variances. SLBs exhibit an average YTM that is 29.95 bps higher than their matched CBs. However, the average RAYTM for SLBs is 7.76 bps lower, suggesting a potential yield advantage or sustainium for SLBs (Table 5). These discrepancies may be

largely attributed to the prevailing market conditions at the time of issuance, including macroeconomic shifts and monetary policy adjustments. In particular, the differences in issuance dates within pairs become more pronounced when considering that SLBs denominated in USD and EUR face a raised risk-free interest rate environment from 2022 due to monetary tightening. (Table 5).

Variable	Min	1th Quartile	Mean	Median	3th Quartile	Max
Maturity SLB (years)	3.04	5.07	7.39	7.11	10.14	30.44
Maturity CB (years)	0.50	5.07	7.13	7.07	10.14	30.44
Maturity diff. (years)	- 2.98	- 0.08	0.26	0.00	1.02	2.97
Issue volume SLB (EUR millions)	94.73	156.76	437.28	414.41	594.55	1500
Issue volume CB (EUR millions)	84.75	206.68	428.09	377.48	596.13	1365.71
Issue volume (ratio)	0.50	0.83	1.05	1.00	1.20	1.96
Issue date diff. (years)	- 3.99	- 2.21	- 1.39	- 1.32	- 0.47	1.61
YTM SLB (bps)	16.00	97.58	283.91	290.90	414.53	935.00
YTM CB (bps)	5.00	64.98	253.96	254.66	390.43	783.00
YTM diff. (bps)	- 299.80	- 31.68	29.95	13.30	73.73	423.20
RAYTM SLB (bps)	7.00	53.76	170.77	133.30	240.39	684.92
RAYTM CB (bps)	- 33.00	57.25	178.52	138.88	242.21	701.47
RAYTM diff. (bps)	- 229.39	- 38.53	- 7.76	- 1.05	30.64	200.40
Total Assets SLB (EUR millions)	982.80	11243.23	87048.52	27680.13	47631.88	4189671.95
Total Assets CB (EUR millions)	749.60	11342.49	84836.86	26093.41	44383.21	4186971.95
Total Assets diff. (ratio)	0.55	1.00	1.09	1.04	1.11	2.49
Total Leverage SLB (pp)	31.20	61.11	70.44	69.00	80.07	107.68
Total Leverage CB (pp)	31.20	60.69	69.77	66.98	77.32	117.70
Total Leverage diff. (pp)	- 12.32	- 0.66	0.67	0.00	1.76	27.00

Table 5: Summary of Bond Pairs.

5 Empirical results

The results provide supporting evidence for a sustainability premium in the primary market for corporate SLBs, aligning with the findings of Koelbel and Lambillon (2022), Bonacina (2022) and Ramirez et al. (2022). The results of the multivariate regression analyses reveal a significant sustainability premium ranging from -13.31 bps to -30.21 bps (Table 6). The observed sustainium reflects an increased market valuation of SLBs' sustainability features, in line with investors' growing preference for ESG-oriented investments.

Dependent Variable: Yield to Maturity at Issuance (%)

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
SLB	- 0.1331*	- 0.1588**	- 0.1588**	- 0.1757**	- 0.2431**	- 0.3021**
	(0.085)	(0.086)	(0.086)	(0.090)	(0.118)	(0.128)
Risk free yield	1.1473***	1.1476***	1.1476***	1.1108***	0.9749***	0.8078***
	(0.075)	(0.075)	(0.075)	(0.076)	(0.101)	(0.113)
Issue Volume		0.1609	0.1609	0.2116	- 0.0200	- 0.6182**
		(0.259)	(0.259)	(0.255)	(0.319)	(0.328)
Maturity		0.0958*	0.0958*	0.1287**	0.1953***	0.1002
		(0.067)	(0.067)	(0.065)	(0.081)	(0.084)
Currency		0.6230***	0.7376***	0.4339**	0.0419	0.0548
		(0.207)	(0.179)	(0.203)	(0.333)	(0.219)
Investment Grade		- 1.2891***	- 0.7320***	- 2.4771***		
		(0.292)	(0.234)	(0.631)		
Callable		0.1450	0.1176	- 0.2420	- 0.7548	- 0.7926*
		(0.417)	(0.387)	(0.506)	(0.727)	(0.600)
Basic Materials			0.6374***	0.4289**	- 0.1312	0.8186***
			(0.204)	(0.210)	(0.545)	(0.285)
Consumer Cyclicals			- 0.2836**	- 0.6776***	0.1328	0.1342
			(0.161)	(0.189)	(0.286)	(0.187)
Consumer Non-Cyclicals			- 0.7086***	- 0.8740***	- 1.0989***	- 0.8463**
			(0.189)	(0.296)	(0.422)	(0.414)
Energy			- 0.4240**	- 0.5187**	0.5304	- 0.0000
			(0.211)	(0.266)	(0.686)	(0.000)
Financials			- 0.4498**	- 0.3855	- 0.7427**	0.8896***
			(0.229)	(0.762)	(0.332)	(0.360)
Industrials			0.1943	0.9461***	0.5245***	1.4862***
			(0.224)	(0.232)	(0.140)	(0.216)
Real Estate			- 0.7498***	- 1.1489***	- 1.6777***	- 2.8767***
			(0.198)	(0.308)	(0.548)	(0.816)
Technology			- 0.7761***	- 0.9742***	- 1.2312***	0.2081
			(0.163)	(0.261)	(0.299)	(0.288)
Utilities			- 0.7246***	- 1.2527***	- 1.0748***	0.1264
			(0.167)	(0.499)	(0.315)	(0.214)
Total assets				0.6785*	0.9900*	2.8493***
				(0.456)	(0.657)	(0.993)
Total leverage				- 0.0090	- 0.0018	- 0.0183
				(0.086)	(0.019)	(0.019)
Rating Grade					- 0.5059**	- 0.5905***
					(0.239)	(0.271)
ESG-Score						- 0.1623***
						(0.051)
Constant	2.7741***	0.7585	0.5916	- 4.0935	- 0.2664	- 0.5108
	(0.384)	(1.401)	(1.321)	(3.693)	(2.088)	(1.271)

Bond Pair FE	YES	YES	YES	YES	YES	YES
Observations	180	180	180	162	108	80
R-Squared	0.962	0.963	0.963	0.967	0.965	0.972
Adj. R-Squared	0.923	0.924	0.924	0.929	0.921	0.935
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 6: Regression results of "baseline model".

This finding provides supporting evidence for hypothesis 1. However, not all issuers utilize SLBs for financial benefits. Rather, SLBs may serve as a strategic tool for issuers who do not benefit from a sustainability premium to demonstrate their commitment to sustainability. Such a strategy could potentially expand the investor base, improve corporate reputation and enhance the sustainability profile (Larcker & Watts, 2020; Tang & Zhang, 2020; Partridge & Medda, 2020).

Fluctuations in risk-free rates, frequently resulting from shifts in monetary policy and varying issue dates within bond pairs, affect the yield spread between SLBs and CBs. This is particularly noteworthy given the time lag in our matched sample and the monetary policy tightening by leading central banks since 2022. In addition, SLBs have experienced a diminishing yield advantage in unstable market conditions post-2021. The decline in SLB issuance volumes in 2022 (-28.49%) and 2023 (-34.87%) underscore the necessity to contextualize bond yields within the prevailing macroeconomic and monetary landscape (Table 2).

		Overall	**2021**	**2022**	**2023**
Information	Bond Pairs (#)	90	33	37	20
	Mean Yield SLB (bps)	170.77	192.60	167.11	141.51
	Mean Yield CB (bps)	178.52	234.51	161.53	117.59
Yield Diff. (bps)	Median	- 1.05	- 34.30	16.00	9.90
	Mean	- 7.76	- 41.90	5.58	23.92
	Standard Deviation	76.53	75.29	78.08	49.67
Shapiro Wilk	W	0.9681	0.975	0.9608	0.8561
	p-value	0.026	0.6263	0.2147	0.0068
T-Test	t-statistic	- 0.9562	- 3.1483	0.4288	2.0985
	p-value (two-tailed)	0.3416	0.0035***	0.6706	0.0495**
	p-value (one-tailed)	0.1708	0.0018***	0.3353	0.0247**
Wilcoxon Signed-Rank	W+	1938	132	412	147
	W-	2157	429	291	63
	p-value (two-tailed)	0.6595	0.007***	0.3696	0.1231
	p-value (one-tailed)	0.3298	0.0035***	0.1848	0.0615*

**** indicates 1% significance, ** at 5%, and * at 10%.*

Table 7: Univariate statistical analysis by annual subsamples and full matching sample.

The higher sustainability premium for callable SLBs in comparison to bullet SLBs is consistent with the evidence of Koelbel and Lambillon (2022). Despite the inherent risks associated with callable SLBs, our findings indicate a preference for these instruments. Early bond calls may signal a default on the SPTs, potentially damaging the issuer's reputation. Therefore, the market may interpret the call feature as a sign of a stronger commitment to sustainability. This view is supported by callable SLB

issuers who are prepared to pay higher initial yields and postpone exercising call options until SPTs are reached. Nevertheless, this counterintuitive preference for callable SLBs merits further investigation to fully comprehend the underlying market dynamics, investor motivations, and issuer effectiveness in meeting SPTs.

Dependent Variable: Yield to Maturity Difference at Issuance (%)

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Risk free yield diff.	1.1473***	1.1234***	1.0592***	1.0832***	0.9749***	1.0016***
	(0.075)	(0.079)	(0.082)	(0.091)	(0.135)	(0.190)
Issue date diff.		0.0208	- 0.0100	- 0.0331	0.0060	0.1127
		(0.063)	(0.067)	(0.078)	(0.111)	(0.150)
Issue volume ratio		0.0015	0.000	0.0003	- 0.0007	- 0.0044
		(0.002)	(0.002)	(0.003)	(0.004)	(0.005)
Maturity diff.		0.1286**	0.1200**	0.1343**	0.1777**	0.0539
		(0.065)	(0.065)	(0.076)	(0.101)	(0.082)
Total assets ratio		0.0061*	0.0046	0.0035	0.0054	0.0228**
		(0.004)	(0.004)	(0.005)	(0.008)	(0.013)
Total leverage diff.		- 0.0112	- 0.0124	- 0.0112	- 0.0063	- 0.0307
		(0.015)	(0.014)	(0.017)	(0.027)	(0.031)
Currency			0. 5239***	0.4962**	0.5642**	0.3973
			(0.218)	(0.192)	(0.298)	(0.354)
Investment Grade			0.1976	0.1603		
			(0.280)	(0.333)		
Callable			- 0.3594*	- 0.3633*	- 0.8558**	- 0.4741
			(0.218)	(0.243)	(0.433)	(0.551)
Basic Materials				- 0.4284	- 1.7411*	- 0.4056
				(0.728)	(1.107)	(1.385)
Consumer Cyclicals				0.0690	0.0313	0.7597
				(0.548)	(0.628)	(0.931)
Consumer Non-Cyclicals				0.0856	- 0.0068	1.0116
				(0.485)	(0.512)	(0.837)
Energy				0.4341	1.1595	0.0000
				(0.669)	(0.944)	(0.000)
Financials				0.3676	0.3599	0.5977
				(0.528)	(0.589)	(1.103)
Industrials				0.2093	0.0679	0.7833
				(0.469)	(0.528)	(0.855)
Real Estate				0.2620	0.1711	1.0057
				(0.554)	(0.660)	(0.932)
Technology				0.0023	0.3207	1.0506
				(0.481)	(0.582)	(0.820)
Utilities				0.1097	0.3138	1.0018
				(0.513)	(0.654)	(0.865)
Rating Grade					- 0.0414	0.0327
					(0.062)	(0.076)
ESG-Score						- 0.0068
						(0.017)
Constant	- 0.1331*	- 0.9230**	- 0.8220**	- 0.8661*	0.1616	- 2.7845
	(0.085)	(0.458)	(0.492)	(0.616)	(1.264)	(2.196)
Observations	90	81	81	81	54	40
R-Squared	0.725	0.766	0.787	0.798	0.796	0.815
Adj. R-Squared	0.722	0.747	0.760	0.739	0.691	0.656

Prob (F)		0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 8: Regression results of "yield difference driver model".

While issuers' ESG ratings do not significantly affect the sustainability premium (Table 8), they are associated with lower issuance yields (Tables 6, 9 and 10). This association suggests that investors attribute a decreased credit risk to firms with robust sustainability practices. This is consistent with the results of Jiraporn et al. (2013) and Shahrour et al. (2021), who suggest that issuers with better sustainability performance tend to receive higher credit ratings and are perceived as having a reduced risk of default.

In contrast to our initial expectations, the severity of step-up penalties and target maturity ratios of SPTs show no significant impact on the yield spread between SLBs and CBs. This leads to the rejection of our second and third hypotheses (Tables 9, 10 and A.16). This finding suggests that the market may be disregarding these characteristics, which raises concerns about ESG washing and the ability of the market to distinguish bonds based on their sustainability commitments. This is a key aspect for upholding the integrity of the SLB market. Such indifference could enable issuers to set lenient penalty rates and strategically position SPT deadlines in order to reduce penalties for non-compliance. Consequently, this investor neglect may result in issuers reaping financial benefits from SLBs without a substantial sustainability commitment.

Dependent Variable: Yield to Maturity at Issuance (%)

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
SLB	- 0.2102**	- 0.4249**	- 0.4197**	- 0.4197**	- 0.2964	- 0.2787	- 0.1279
	(0.124)	(0.235)	(0.238)	(0.238)	(0.232)	(0.279)	(0.333)
Risk free yield	1.2183***	1.1940***	1.2004***	1.2004***	1.2392***	1.1463***	0.9529***
	(0.108)	(0.110)	(0.114)	(0.114)	(0.107)	(0.127)	(0.177)
SLB * Step-up		0.0040	0.0034	0.0034	0.0022	0.0006	- 0.0050
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Issue Volume			0.2101	0.2101	0.4306	0.3671	- 0.4353
			(0.396)	(0.396)	(0.382)	(0.405)	(0.509)
Maturity			0.0760	0.0760	0.0889	0.1411*	0.0804
			(0.093)	(0.093)	(0.088)	(0.100)	(0.111)
Currency			0.4638**	0.5124**	0.4208	0.2857	0.1309
			(0.259)	(0.226)	(0.335)	(0.357)	(0.301)
Investment			- 1.1806***	- 0.3009	- 1.1405		
Grade			(0.360)	(0.269)	(1.336)		
Callable			- 0.0077	- 0.1806	- 0.2261	- 0.7010	- 1.9711**
			(0.609)	(0.599)	(0.584)	(0.845)	(0.934)
Basic Materials				0.8116***	0.000	- 0.0000	0.000*
				(0.234)	(0.000)	(0.000)	(0.000)
Consumer				0.7708***	0.4225	0.5048	- 0.5202
Cyclicals				(0.239)	(0.613)	(0.586)	(0.861)
Consumer Non-				- 0.6024**	- 0.1533	- 0.4565	- 1.4485**
Cyclicals				(0.274)	(0.564)	(0.493)	(0.698)

Energy				- 0.5145**	- 0.3145	- 0.0768	0.0000**
				(0.241)	(0.391)	(0.891)	(0.000)
Financials				- 0.6292*	- 0.3484	- 0.6539*	0.8581**
				(0.479)	(0.613)	(0.422)	(0.467)
Industrials				0.5065**	1.0094***	0.7652***	1.1933***
				(0.320)	(0.185)	(0.165)	(0.239)
Real Estate				0.0000	0.000	0.000*	0.000**
				(0.000)	(0.000)	(0.000)	(0.000)
Technology				- 0.8299***	- 0.5299**	- 0.9109***	0.0979
				(0.256)	(0.255)	(0.220)	(0.438)
Utilities				- 0.8474***	- 0.4394	- 0.5748*	- 0.2646
				(0.194)	(0.505)	(0.354)	(0.245)
Total assets					- 0.0680	0.2211	3.4175**
					(0.724)	(0.814)	(1.542)
Total leverage					- 0.0116	- 0.0025	- 0.0207
					(0.019)	(0.023)	(0.024)
Rating Grade						- 0.2331	- 0.8222**
						(0.356)	(0.440)
ESG-Score							- 0.1716***
							(0.063)
Constant	2.7520***	2.7799***	0.7561	0.4225	0.9471	0.7248	- 1.1244
	(0.426)	(0.427)	(2.214)	(2.014)	(5.396)	(2.021)	(1.423)
Bond Pair FE	YES	YES	YES	YES	YES	YES	YES
Observations	102	102	102	102	94	78	56
R-Squared	0.947	0.949	0.950	0.950	0.959	0.957	0.966
Adj. R-Squared	0.892	0.892	0.890	0.890	0.905	0.897	0.912
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 9: Regression results of "step-up level model".

The observation that investors tend to disregard step-up penalties in SLB pricing is important because our data indicates that issuers still benefit from a sustainability premium despite these penalties. SLBs are issued at an average yield discount of -13.31 bps compared to their conventional counterparts, whereas the average coupon step-up penalty for not meeting SPTs is 26.27 bps. Although these sanctions make SLBs costlier, their financial impact is substantially mitigated by their time-weighted nature. Specifically, our matched data shows that such penalties would only affect around 32% of the remaining bond life, translating to roughly 2.36 years on average (Tables 5 and A.10). This approximate average-based cost-benefit analysis suggests that non-compliance with SPTs increases costs but only reduces the yield benefit of SLBs rather than eliminating it. This is consistent with the observations of Liberadzki et al. (2021). Nevertheless, the potential reputational consequences of failing to meet SPTs may dissuade issuers from setting unachievable targets, thereby reducing the probability of sanctions (Koelbel & Lambillon, 2022; Liberadzki et al., 2021).

Our analysis also contributes to the understanding of the target maturity ratio in SLBs and its impact on the sustainability premium. This ratio, indicative of the timeline for achieving SPTs in comparison to the bond tenor, could be a factor in assessing the issuer's ambition and commitment to sustainability goals. Ul Haq and Doumbia (2022) discuss how issuers might strategically place these deadlines within

the bond's lifespan to potentially mitigate the duration of heightened coupon payments if targets are missed. We show that most SLBs set their SPT deadlines towards the latter part of their maturity. Our findings also reveal a negligible or non-existent relationship between the target maturity ratio and the sustainability premium. This insight, corroborated by the targeted analysis of SLBs with coupon step-up mechanisms (Table 26), leads to the rejection of our third hypothesis. Consequently, our results suggest that the timing of SPT deadlines may not be as influential on the yield benefits of SLBs as originally hypothesized.

Dependent Variable: Yield to Maturity at Issuance (%)

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
SLB	- 0.1416*	- 0.6663**	- 0.6313**	- 0.6313**	- 0.5771*	- 0.6576*	- 0.6773*
	(0.091)	(0.356)	(0.359)	(0.359)	(0.366)	(0.441)	(0.452)
Risk free yield	1.1538***	1.1396***	1.1430***	1.1430***	1.1082***	0.9625***	0.8010***
	(0.081)	(0.081)	(0.081)	(0.081)	(0.083)	(0.102)	(0.113)
SLB * Target		0.0039*	0.0034*	0.0034*	0.0030	0.0032	0.0028
Maturity Ratio		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Issue Volume			0.1109	0.1109	0.1652	- 0.0618	- 0.6768**
			(0.277)	(0.277)	(0.280)	(0.322)	(0.336)
Maturity			0.0951*	0.0951*	0.1241**	0.1822**	0.0870
			(0.071)	(0.071)	(0.071)	(0.082)	(0.086)
Currency			0. 5856***	0.7049***	0.4144**	0.0127	0.0522
			(0.221)	(0.192)	(0.242)	(0.335)	(0.220)
Investment			- 1.3586***	- 0.7366***	- 2.3447***		
Grade			(0.304)	(0.232)	(0.849)		
Callable			0.2751	0.2189	- 0.1167	- 0.5810	- 0.6534**
			(0.454)	(0.421)	(0.479)	(0.749)	(0.623)
Basic Materials				0.6304***	0.4322**	- 0.0520	0.8421***
				(0.217)	(0.251)	(0.552)	(0.287)
Consumer				- 0.2857**	- 0.6699***	0.0605	0.1077
Cyclicals				(0.167)	(0.267)	(0.296)	(0.190)
Consumer Non-				- 0.6381***	- 0.8246**	- 1.0393***	- 0.7430**
Cyclicals				(0.203)	(0.454)	(0.427)	(0.433)
Energy				- 0.4284**	- 0.5171*	0.4564	- 0.0000**
				(0.222)	(0.314)	(0.691)	(0.000)
Financials				- 0.5131**	- 0.6185*	- 0.6662**	0.8814**
				(0.244)	(0.409)	(0.341)	(0.362)
Industrials				0.2981	0.9911***	0.5412***	1.5156***
				(0.246)	(0.215)	(0.141)	(0.220)
Real Estate				- 0.7578***	- 1.1186***	- 1.6504***	- 2.7752***
				(0.201)	(0.437)	(0.549)	(0.827)
Technology				- 0.7859***	- 0.9688***	- 1.2090***	0.2431
				(0.168)	(0.307)	(0.300)	(0.292)
Utilities				- 0.7029***	- 1.0030**	- 1.0504***	0.1489
				(0.170)	(0.505)	(0.316)	(0.216)
Total assets					0.6267	0.9220*	2.7151***
					(0.565)	(0.661)	(1.009)
Total leverage					- 0.0089	- 0.0018	- 0.0171
					(0.015)	(0.019)	(0.019)
Rating Grade						- 0.4722**	- 0.5551***
						(0.241)	(0.221)
ESG-Score							- 0.1525***
							(0.053)

Constant	2.7728***	2.9115***	1.0851	0.8431	- 3.4814	0.1105	- 0.2348
	(0.396)	(0.403)	(1.522)	(1.431)	(4.343)	(2.125)	(1.315)
Bond Pair FE	YES	YES	YES	YES	YES	YES	YES
Observations	166	166	166	166	148	108	80
R-Squared	0.962	0.963	0.964	0.964	0.968	0.965	0.973
Adj. R-Squared	0.923	0.925	0.925	0.925	0.929	0.921	0.935
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 10: Regression results of "target maturity ratio level model".

6 Discussion

Our research emphasizes the sustainability premium in SLBs as a dual incentive for firms. On the one hand, it offers an efficient funding mechanism for issuers aiming at sustainable business transformation. On the other hand, it encourages firms to undertake sustainability improvements. These improvements can gradually lead to higher ESG ratings, resulting in lower yields at issuance. The dual benefit thus highlights a compelling motivation for issuers to align financial strategies with sustainability objectives. Firms may use SLBs to demonstrate their commitment to sustainability, even without a sustainability premium. Such a strategy could enhance their investor appeal (Larcker & Watts, 2020; Tang & Zhang, 2020; Partridge & Medda, 2020), attracting both those dedicated to sustainable value creation and those interested in the long-term economic gains of sustainable corporate governance. In essence, for firms with sound sustainability practices, SLBs effectively translate sustainability strategies into tangible financial benefits and reaffirm their ongoing commitment to sustainability.

The sustainium phenomenon represents a pivotal shift for investors towards integrating sustainable considerations into their financial decisions and signifies a material change in the investment landscape. In light of these market trends, it is appropriate to examine the distinctive features of SLBs that contribute to their prominence in the financial landscape. Beyond the raising of capital, SLBs symbolize a commitment to sustainability, harmonizing investor returns with corporate ESG strategies. In addition to this symbolic value, their design featuring SPTs enables investors to finance targeted sustainability enhancements.

In light of these considerations, it is crucial to comprehend the evolving investor motivations driving this market preference for these sustainable instruments. On the one hand, socially responsible or impact investors prioritize direct contributions to sustainability. These investors are often willing to accept lower yields, while aligning with their ESG objectives (Povilonis, 2022; Vulturius et al., 2022). On the other hand, a subset of investors is drawn to the long-term economic benefits and reduced financial risk associated with sustainable practices. These benefits include lower default risk (Shahrour et al., 2021) and regulatory compliance. In this context, firms with robust sustainability management

are perceived as more resilient (Liberadzki et al., 2021), better equipped to manage the long-term economic impacts of climate change (Zerbib, 2017) and more adaptable in dealing with evolving regulatory demands. For example, Subran et al. (2023) highlight the detrimental effects of climate-related heatwaves on GDP. The market is pricing in the positive externalities associated with sustainable business operations. In light of these insights, the emerging perception of SLBs as financially prudent and ethical investments, particularly given their scarcity, could further drive the sustainability premium.

The current market indifference to coupon step-up penalties and target maturities in SLB pricing may not effectively deter suboptimal sustainability objectives or incentives. This leads to an elevated risk of ESG washing, characterized by issuers engaging in minimal sustainability efforts. Investors' limited capability or readiness to critically assess sustainability commitments might explain the market's current response. Moreover, the nascent SLB market may be adapting to ESG washing, often giving issuers the benefit of the doubt. Nevertheless, to genuinely improve sustainability practices through SLBs, SPTs must balance ambition with feasibility, underpinned by substantial incentives and realistic timeframes. For instance, issuers could set goals that are either not challenging or already met at the time of bond issuance (Vejarano & Swinkels, 2023). Consequently, the sole reliance on these metrics may not accurately reflect a genuine sustainability commitment or identify potential ESG washing.

This market indifference suggests a need for stronger regulation, increased investor education, stricter investor scrutiny and enhanced market standards to accurately assess and incentivize genuine sustainability efforts. These measures would not only sharpen the effectiveness of coupon step-up penalties and target maturity ratios as indicators of actual sustainability impact but also encourage issuers towards greater transparency and genuine sustainability efforts. This could also enhance market credibility and investor confidence, thereby attracting more investment to SLBs (Chang, 2022; ICMA, 2023). This, in turn, would contribute to lower capital costs for issuers. In addition, investor due diligence, standardization and regulatory oversight would promote a fairer market, rewarding issuers that are genuinely committed sustainable.

In summary, our research provides insights into the SLB market, demonstrating the influence of the sustainability premium on corporate actions and investment decisions that align with sustainable finance objectives. While SLBs represent an innovative approach to integrating finance with sustainability objectives, questions remain about the alignment of financial motives and genuine sustainability commitments. Therefore, our study emphasizes the necessity for standardization, stricter regulation and heightened investor vigilance to counteract ESG washing and ensure authentic sustainability commitments. This could result in SLBs becoming a viable long-term sustainable investment and a key financing tool in the debt market, aiding the transformation to a sustainable economy.

7 Conclusion

The objective of this study is to determine whether SLBs exhibit a lower initial YTM, indicating a "sustainium" and to explore how coupon step-up penalties and target maturity ratios explain this sustainium. Analyzing SLBs issued between 2021 and 2023, matched with CBs by the same issuers and with similar characteristics, our findings show that SLBs offer issuers an average debt cost savings of 13.31 to 30.21 bps over CBs, thereby confirming the presence of a sustainability premium. Contrary to our initial assumptions, we report that the severity of coupon step-up penalties and the target maturity ratios of SPTs do not have a significant impact on the sustainium. It appears that these factors are either overlooked by the market or perceived as insufficient indicators of authentic sustainability commitment. This observation raises concerns about ESG washing and underscores the need for stricter regulatory frameworks, improved investor education, and enhanced market oversight to ensure that SLBs effectively foster genuine and material sustainability improvements.

Appendix

Region	2021	YoY Growth	2022	YoY Growth	2023 (09/16/23)	Total
Europe	41629.34	- *12.94%*	36243.06	- *40.99%*	21388.22	99260.63
(EUR millions)	(58.68%)		(71.45%)		(64.74%)	(64.16%)
Americas	16851.16	- *56.72%*	7293.94	- *35.70%*	4689.74	28834.84
(EUR millions)	(23.75%)		(14.38%)		(14.19%)	(18.64%)
Asia Pacific (excl. Central Asia)	7242.04	- *34.39%*	4751.71	- *67.81%*	1529.39	19951.50
(EUR millions)	(10.21%)		(9.37%)		(4.63%)	(8.74%)
Africa, Middle East or Central Asia	4327.56	- *100%*	0.00	*N/A*	2331.41	6658.97
(EUR millions)	(6.1%)		(0.00%)		(7.06%)	(4.30%)
Japan	887.91	+ *174.69%*	2439.90	+ *27.08%*	3100.54	6428.36
(EUR millions)	(1.25%)		(4.81%)		(9.38%)	(4.16%)
Total Issue Volume	**70938.01**	**- 28.49%**	**50728.61**	**- 34.87%**	**33039.31**	**154705.94**

The percentage represents the region's contribution to the total issue volume indicated in the respective column.

Table 11: SLBs across regions and over time.

Rating Class	Bonds (Number)	Issue Size (EUR millions)	Issue Size Mean (EUR millions)	#Bonds with YTM Data	YTM Mean (bps)	RAYTM Mean (bps)
Investment Grade	296 (77.69%)	116084.21 (75.04%)	392.18	261	295.06	172.80
Speculative Grade	85 (22.31%)	38621.73 (24.96%)	182.62	77	510.47	419.86

Table 12: SLBs by credit rating classes.

Security Type	#Bonds (Number)	Issue Size (EUR millions)	Issue Size Mean (EUR millions)	Bonds with YTM Data	YTM Mean (bps)	RAYTM Mean (bps)
Senior Unsecured	333 (87.40%)	139068.33 (89.89%)	417.62	302	317.00	199.91
Senior Secured	43 (11.29%)	14890.37 (9.62%)	346.29	31	560.15	453.28
Subordinate Unsecured	4 (1.05%)	437.23 (0.28%)	109.31	4	475.00	602.25
Subordinate Secured	1 (0.26%)	310.00 (0.20%)	310.00	1	537.50	596.15

Table 13: SLBs by security types.

Sector	2021	YoY Growth	2022	YoY Growth	2023 (09/16/23)	Total
Utilities	16975.62	- *24.32%*	12847.32	- *61.37%*	4962.94	34785.89
(EUR millions)	(23.93%)		(25.33%)		(15.02%)	(22.49%)
Industrials	10458.74	- *32.75%*	7036.07	+ *9.25%*	7686.97	25181.78
(EUR millions)	(14.74%)		(13.87%)		(23.27%)	(16.28%)
Financials	11245.43	- *8.87%*	10248.49	- *64.19%*	3670.37	25164.30
(EUR millions)	(15.85%)		(20.2%)		(11.11%)	(16.27%)
Consumer Non-Cyclicals	7522.07	- *7.51%*	6956.97	- *74.65%*	1763.78	16242.81
(EUR millions)	(10.6%)		(13.71%)		(5.34%)	(10.5%)
Basic Minerals	9554.04	- *58.32%*	3981.89	- *44.13%*	2224.76	15760.69
(EUR millions)	(13.47%)		(7.85%)		(6.73%)	(10.19%)
Consumer Cyclicals	5626.45	- *62.38%*	2116.69	+ *67.96%*	3554.46	11297.61
(EUR millions)	(7.93%)		(4.17%)		(10.76%)	(7.3%)
Technology	2887.79	+ *19.14%*	3440.63	+ *2.17%*	3515.20	9843.62
(EUR millions)	(4.07%)		(6.78%)		(10.64%)	(6.36%)
Healthcare	4557.78	- *78.11%*	997.75	+ *133.67%*	2331.41	7886.95
(EUR millions)	(6.43%)		(1.97%)		(7.06%)	(5.1%)
Energy	1462.40	+ *7.31%*	1569.24	+ *59.19%*	2498.12	5529.76
(EUR millions)	(2.06%)		(3.09%)		(7.56%)	(3.57%)
Real Estate	232.83	+ *558.66%*	1533.56	- *45.79%*	831.29	2597.67
(EUR millions)	(0.33%)		(3.02%)		(2.52%)	(1.68%)
Other	414.86	*N/A*	0.00	*N/A*	0.00	414.86
(EUR millions)	(0.58%)		(0.00%)		(0.00%)	(0.27%)
Total Issue Volume	**70938.01**	**- 28.49%**	**50728.61**	**- 34.87%**	**33039.31**	**154705.94**

The percentage indicates the share of the sector in the total issue volume of the respective column

Table 14: SLBs across sectors and over time.

Variable	#Bonds	Min	1th Quartile	Mean	Median	3th Quartile	Max
Total Assets (EUR millions)	267	45.46	3769.57	38580.86	10503.13	27420.57	4189671.95
Total Leverage (pp)	267	3.52	55.77	66.83	65.37	77.44	127.92
Credit Rating (Numeric)	246	0	12	14.23	15	16	23
ESG-Score (pp)	186	29.99	63.54	70.82	74.92	80.88	94.89
Coupon Rate (bps)	338	10	136.38	339.94	329.50	475.00	13.50
YTM (bps)	338	10	137.07	344.14	333.55	475.48	13.50
RAYTM (bps)	338	5.31	98.50	229.08	179.13	314.71	111.36
Issue Volume (EUR millions)	381	5.03	128.66	406.05	349.14	594.65	2151.19
Maturity (years)	377	3.04	5.07	7.57	7.10	10.14	35.51

Table 15: Descriptive data on various bond and issuer characteristics.

Maturity Type	Bonds (Number)	Issue Size (EUR millions)	Issue Size Mean (EUR millions)	#Bonds with YTM Data	YTM Mean (bps)	RAYTM Mean (bps)
Callable	236 (61.94%)	128614.63 (83.13%)	544.98	216	386.76	272.78
At Maturity	141 (37.01%)	25750.10 (16.64%)	182.62	118	255.22	138.06
Perpetual	4 (1.05%)	341.20 (0.22%)	85.30	4	665.50	511.37

Table 16: SLBs by maturity types.

Targets per SLB	Bonds (Number)
1	220 (70.06%)
2	61 (19.43%)
3	30 (9.55%)
More than 3	3 (0.96%)
Total	**314 (100%)**

Table 17: SLB target count distribution overview.

SPT Theme	Targets (Number)
GHG Emissions	308 (69.06%)
Other	69 (15.47%)
Recycling	28 (6.28%)
Air Quality	14 (3.14%)
Diversity	13 (2.91%)
ESG Rating	8 (1.79%)
Waste	5 (1.12%)
Biodiversity	1 (0.22%)
Total	**446 (100%)**

Table 18: SLBs by SPT themes.

SPT Penalty Type	Targets (Number)
Coupon Step-Up	290 (65.02%)
Premium Redemption	89 (19.96%)
Other	53 (11.88%)
Charity Donation	6 (1.35%)
Carbon Credit	4 (0.90%)
Early Redemption	2 (0.45%)
Coupon Step-Up and Maturity Extension	2 (0.45%)
Total	**446 (100%)**

Table 19: SLBs by SPT incentive types.

Variable	SLB Group	Mean	Median
ESG Score (pp)	Matched	73.99	77.12
	Market	70.82	74.92
	Difference	3.17	2.20
Step-Up Bps (bps)	Matched	26.27	25.00
	Market	26.38	25.00
	Difference	- 0.11	0.00
Target Maturity Ratio (pp)	Matched	68.16	71.92
	Market	64.26	66.48
	Difference	3.90	5.44
Credit Rating (Numerical)	Matched	15.25	15.00
	Market	14.23	15.00
	Difference	1.02	0.00

Table 20: SLB Market vs. Matched Sample comparison.

Variable		SLB Group	Issues Share	Issue Volume Share
Region	Europe	Matched	42.22%	52.86%
		Market	54.33%	64.16%
		Difference relative	- 22.29%	- 17.61%
	Americas	Matched	14.44%	17.23%
		Market	15.49%	18.64%
		Difference relative	- 6.77%	- 7.56%
	Asia Pacific (excl. Central Asia)	Matched	17.78%	10.19%
		Market	16.01%	8.74%
		Difference relative	+ 11.06%	+ 16.59%
	Africa, Middle East or Central Asia	Matched	4.44%	11.00%
		Market	2.1%	4.30%
		Difference relative	+ 111.43%	+ 155.81%
	Japan	Matched	21.11%	8.72%
		Market	12.07%	4.16%
		Difference relative	+ 74.90%	+ 109.62%
Currency	EUR	Matched	36.67%	53.62%
		Market	40.16%	55.15%
		Difference relative	- 8.69%	- 2.77%
	USD	Matched	17.78%	23.69%
		Market	21.52%	29.29%
		Difference relative	- 17.38%	- 19.12%
	JPY	Matched	21.11%	8.72%
		Market	12.6%	4.26%
		Difference relative	+ 67.54%	+ 104.69%
	CNY	Matched	8.89%	6.64%
		Market	4.2%	2.14%
		Difference relative	+ 111.66%	+ 210.28%
	GBP	Matched	0.0%	0.0%
		Market	2.1%	1.84%
		Difference relative	- 100.00%	- 100.00%

	CAD	Matched	3.33%	2.84%
		Market	1.31%	1.29%
		Difference relative	+ 154.20%	+ 151.55%
	SEK	Matched	0.0%	0.0%
		Market	5.51%	1.14%
		Difference relative	- 100.00%	- 100.00%
	Other	Matched	12.22%	4.49%
		Market	12.6%	4.89%
		Difference relative	- 3.02%	- 8.18%
Total (EUR millions)		**Matched**	**90**	**39355.44**
		Market	**381**	**154705.94**
		Share Matched Sample of Market (%)	**23.62%**	**25.44%**

Table 21: SLB Market vs. Matched Sample comparison by regions and currencies.

Variable		**SLB Group**	**Issues Share**	**Issue Volume Share**
Sector	Utilities	Matched	12.22%	8.33%
		Market	15.22%	22.49%
		Difference relative	- 19.71%	- 62.96%
	Industrials	Matched	22.22%	17.12%
		Market	21.26%	16.28%
		Difference relative	+ 4.52%	+ 5.16%
	Financials	Matched	14.44%	16.75%
		Market	19.69%	16.27%
		Difference relative	- 26.66%	+ 2.95%
	Consumer Non-Cyclicals	Matched	14.44%	19.99%
		Market	9.71%	10.5%
		Difference relative	+ 48.71%	+ 90.38%
	Basic Minerals	Matched	3.33%	1.74%
		Market	11.29%	10.19%
		Difference relative	- 70.50%	- 82.92%
	Consumer Cyclicals	Matched	6.67%	5.49%
		Market	7.87%	7.3%
		Difference relative	- 15.25%	- 24.79%
	Technology	Matched	11.11%	13.13%
		Market	5.25%	6.36%
		Difference relative	+ 111.62%	+ 106.45%
	Healthcare	Matched	5.56%	12.64%
		Market	3.41%	5.1%
		Difference relative	+ 63.05%	+ 147.84%
	Energy	Matched	2.22%	11.00%
		Market	2.10%	3.57%
		Difference relative	+ 5.71%	+ 208.12%
	Real Estate	Matched	7.78%	3.23%
		Market	3.94%	1.68%
		Difference relative	+ 97.46%	+ 92.26%
	Other	Matched	0.0%	0.0%
		Market	0.26%	0.27%

		Difference relative	- 100.00%	- 100.00%
Total (EUR millions)		**Matched**	**90**	**39355.44**
		Market	**381**	**154705.94**
		Share Matched Sample of Market (%)	**23.62%**	**25.44%**

Table 22: SLB Market vs. Matched Sample comparison by sectors.

Variable		**SLB Group**	**Issues Share**	**Issue Volume Share**
Maturity Type	At Maturity	Matched	45.56%	24.12%
		Market	37.01%	16.64%
		Difference relative	+ 23.11%	+ 44.95%
	Callable	Matched	54.44%	75.88%
		Market	61.94%	83.13%
		Difference relative	- 12.11%	- 8.72%
Rating Class	Investment Grade	Matched	84.44%	75.23%
		Market	77.69%	75.04%
		Difference relative	+ 8.69%	+ 0.25%
	Speculative Grade	Matched	15.56%	24.77%
		Market	22.31%	24.96%
		Difference relative	- 30.26%	- 0.76%
Total (EUR millions)		**Matched**	**90**	**39355.44**
		Market	**381**	**154705.94**
		Share Matched Sample of Market (%)	**23.62%**	**25.44%**

Table 23: SLB Market vs. Matched Sample comparison by maturity types and credit rating classes.

		At Maturity	**Callable**	**Step-Up**	**No Step-Up**
Information	Bond Pairs (#)	41	49	51	32
	Mean Yield SLB (bps)	99.66	230.26	216.08	109.64
	Mean Yield CB (bps)	103.34	241.43	228.73	111.35
Yield Diff. (bps)	Median	- 3.10	7.20	- 16.00	2.20
	Mean	- 3.68	- 11.17	- 12.65	- 1.70
	Standard Deviation	54.94	90.59	84.98	67.13
Shapiro Wilk	W	0.8396	0.9707	0.9919	0.8778
	p-value	0.0000	0.2573	0.9793	0.0018
T-Test	t-statistic	- 0.4232	- 0.8544	- 1.053	- 0.1414
	p-value (two-tailed)	0.6744	0.3971	0.2974	0.8884
	p-value (one-tailed)	0.3372	0.1986	0.1487	0.4442
Wilcoxon Signed-Rank	W+	404	564	573	290
	W-	457	661	753	238
	p-value (two-tailed)	0.7388	0.6359	0.3989	0.6379
	p-value (one-tailed)	0.3694	0.318	0.1994	0.3189

**** indicates 1% significance, ** at 5%, and * at 10%.*

Table 24: Univariate statistical analysis according to various categorized samples.

Dependent Variable: Yield to Maturity at Issuance (%)

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
SLB 2021	-0.4152***	-0.4334***	-0.4334***	-0.3488***	-0.5748***	-0.5953***
	(0.127)	(0.127)	(0.127)	(0.134)	(0.176)	(0.191)
SLB 2022	0.0356	0.0029	0.0029	0.0761	0.0341	-0.1285
	(0.123)	(0.124)	(0.124)	(0.135)	(0.173)	(0.184)
SLB 2023	0.1659	0.1494	0.1494	0.0635	-0.1007	-0.0336
	(0.190)	(0.193)	(0.193)	(0.210)	(0.260)	(0.247)
Risk free yield	1.0614***	1.0617***	1.0617***	1.0546***	0.8945***	0.7403***
	(0.081)	(0.081)	(0.081)	(0.083)	(0.104)	(0.115)
Issue Volume		0.1756	0.1756	0.2568	-0.1352	-0.6218**
		(0.254)	(0.254)	(0.260)	(0.329)	(0.327)
Maturity		0.0884*	0.0884*	0.1204**	0.1747**	0.0715
		(0.064)	(0.064)	(0.065)	(0.079)	(0.083)
Currency		0.4729**	0.5821***	0.3658**	-0.0034	-0.0356
		(0.206)	(0.181)	(0.206)	(0.320)	(0.217)
Investment		-1.3441***	-0.7978***	-2.3106***		
Grade		(0.284)	(0.227)	(0.637)		
Callable		0.2363	0.1825	-0.3736	-0.3465	-0.4319
		(0.406)	(0.377)	(0.516)	(0.731)	(0.635)
Basic Materials			0.7077***	0.4703**	0.0514	0.9510***
			(0.200)	(0.211)	(0.531)	(0.284)
Consumer			-0.4196***	-0.7755***	0.0177	0.0215
Cyclicals			(0.169)	(0.210)	(0.280)	(0.201)
Consumer Non-			-0.6716***	-0.7625***	-0.8971**	-0.5980*
Cyclicals			(0.183)	(0.301)	(0.414)	(0.432)
Energy			-0.3053*	-0.3428**	0.3913	-0.0000
			(0.210)	(0.283)	(0.675)	(0.000)
Financials			-0.4219**	0.0077	-0.6748**	0.6729**
			(0.221)	(0.788)	(0.319)	(0.366)
Industrials			0.1944	0.8497***	0.5262***	1.4805***
			(0.217)	(0.237)	(0.136)	(0.210)
Real Estate			-0.8814***	-1.2392***	-1.6086***	-2.6282***
			(0.200)	(0.318)	(0.526)	(0.822)
Technology			-0.8269***	-0.9312***	-1.1002***	0.2288
			(0.160)	(0.264)	(0.293)	(0.283)
Utilities			-0.6661***	-1.1029**	-1.0458***	0.1051
			(0.163)	(0.505)	(0.303)	(0.207)
Total assets				0.5291	0.7767	2.4105**
				(0.463)	(0.636)	(1.005)
Total leverage				-0.0018	0.0068	-0.0052
				(0.015)	(0.019)	(0.019)
Rating Grade					-0.4200**	-0.4979**
					(0.232)	(0.221)
ESG-Score						-0.1415***
						(0.052)
Constant	2.9885***	0.8448	0.7042	-3.3387	0.4994	-0.0026
	(0.378)	(1.371)	(1.291)	(3.767)	(2.067)	(1.304)
Bond Pair FE	YES	YES	YES	YES	YES	YES
Observations	180	180	180	162	108	80
R-Squared	0.966	0.967	0.967	0.969	0.969	0.975
Adj. R-Squared	0.929	0.929	0.929	0.931	0.928	0.939
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 25: Regression results of "baseline model" segmented by years.

Dependent Variable: Yield to Maturity at Issuance (%)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SLB	- 0.6379*	- 0.6065	- 0.6065	- 0.6602*	- 0.6080	- 0.5131
	(0.460)	(0.476)	(0.476)	(0.462)	(0.531)	(0.634)
Risk free yield	1.2015***	1.2036***	1.2036***	1.2252***	1.1296***	0.9847***
	(0.109)	(0.114)	(0.114)	(0.107)	(0.128)	(0.180)
SLB * Target	0.0034	0.0029	0.0029	0.0038	0.0029	0.0010
Maturity Ratio	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Issue Volume		0.1662	0.1662	0.3412	0.2885	- 0.4160
		(0.407)	(0.407)	(0.390)	(0.418)	(0.562)
Maturity		0.0839	0.0839	0.0968	0.1397*	0.0591
		(0.093)	(0.093)	(0.086)	(0.096)	(0.112)
Currency		0. 4313*	0. 4933**	0.3755	0.2246	0.1029
		(0.269)	(0.269)	(0.333)	(0.362)	(0.314)
Investment		- 1.2335***	- 0.3395	- 1.3037		
Grade		(0.336)	(0.273)	(0.849)		
Callable		0.0790	- 0.1161	- 0.1442	- 0.5534	- 1.4486**
		(0.631)	(0.616)	(0.578)	(0.799)	(0.797)
Basic Materials			0.7557***	- 0.0000	- 0.0000	- 0.0000***
			(0.237)	(0.000)	(0.000)	(0.000)
Consumer			0.7505***	0.3553	0.5539	0.0176
Cyclicals			(0.239)	(0.564)	(0.547)	(0.706)
Consumer Non-			- 0.5833**	- 0.2005	- 0.4442	- 1.0358**
Cyclicals			(0.281)	(0.528)	(0.471)	(0.433)
Energy			- 0.5533**	- 0.4157	- 0.1895	- 0.0000*
			(0.236)	(0.363)	(0.853)	(0.000)
Financials			- 0.6234	- 0.3725	- 0.6109*	0.7977*
			(0.484)	(0.559)	(0.395)	(0.476)
Industrials			0.5588*	1.0229***	0.7758***	1.2347***
			(0.334)	(0.181)	(0.156)	(0.261)
Real Estate			- 0.0000	- 0.0000	- 0.0000	- 0.0000***
			(0.000)	(0.000)	(0.000)	(0.000)
Technology			- 0.7785***	- 0.5240**	- 0.9100***	0.0239
			(0.257)	(0.251)	(0.218)	(0.451)
Utilities			- 0.8220***	- 0.5263	- 0.5854*	- 0.2014
			(0.195)	(0.551)	(0.347)	(0.244)
Total assets				0.0442	0.1984	2.5833**
				(0.671)	(0.769)	(1.273)
Total leverage				- 0.0140	- 0.0045	- 0.0205
				(0.019)	(0.022)	(0.024)
Rating Grade					- 0.2023	- 0.5742*
					(0.336)	(0.365)
ESG-Score						- 0.1316***
						(0.050)
Constant	2.8628***	0.9665	0.6028	- 0.1484	1.0313	- 0.2188
	(0.442)	(2.282)	(2.071)	(5.586)	(1.877)	(1.171)
Bond Pair FE	YES	YES	YES	YES	YES	YES
Observations	102	102	102	94	78	56
R-Squared	0.948	0.950	0.950	0.960	0.958	0.965
Adj. R-Squared	0.891	0.889	0.889	0.907	0.898	0.908
Prob (F)	0.000	0.000	0.000	0.000	0.000	0.000

**** indicates 1% significance, ** at 5%, and * at 10% (one-tailed). Parentheses enclose standard errors*

Table 26: Regression results of "target maturity ratio level model" consisting of only coupon-step up bond pairs.

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